Claims

What is claimed is:

1. A mold for forming spacers on a flat panel display comprising a photolithographic material.

2. The mold of claim 1, wherein the photolithographic material is an epoxy bisphenol A novolac resin.

3. The mold of claim 2, wherein the epoxy bisphenol A novolac resin is SU-8.

4. The mold of claim 2, further comprising a crosslinking agent.

5. The mold of claim 4, wherein the crosslinking agent is a polyol.

6. A mold for forming spacers on a flat panel display comprising a photolithographic material, wherein the photolithographic material comprises an epoxy bisphenol A novolac resin and a crosslinking agent.

7. The mold of claim 6, wherein the epoxy bisphenol A novolac resin is SU-8.

8. The mold of claim 6, wherein the crosslinking agent is a polyol.

9. The mold of claim 8, wherein the polyol is at least one of triol and a diol.

10. The mold of claim 9, wherein the polyol is a diol.

11. The mold of claim 10, wherein the diol is at least one of a propanediol, a hexanediol and an ethylene glycol.

12. The mold of claim 10, wherein the ratio of terminal groups in the epoxy bisphenol A novolac resin to terminal groups in the diol is about 1.5 to about 1.

13. A mold for forming spacers on a flat panel display, wherein the mold is prepared by the process comprising:

preparing a composition comprising a photolithographic material;

applying the composition on a support;

applying a photomask over the composition;

curing exposed portions of the composition; and

removing un-cured portions of the composition to reveal the mold.

14. The mold of claim 13, wherein the photolithographic material is an epoxy

bisphenol A novolac resin.

15. The mold of claim 14, wherein the epoxy bisphenol A novolac resin is SU-8.

16. The mold of claim 13, wherein the composition further comprises a crosslinking agent.

17. The mold of claim 16, wherein the crosslinking agent is a diol.

18. The mold of claim 17, wherein the diol is propanediol, hexanediol or ethylene glycol.

19. The mold of claim 13, wherein the composition further comprises a solvent and a photoinitiator.

20. The mold of claim 19, wherein the photolithographic material is present in an amount of 200-600 parts by weight, wherein the solvent is present in an amount of 200-600 parts by weight, and wherein the photoinitiator is present in an amount of about 1-100 parts by weight.

21. The mold of claim 13, further comprising priming the support with a priming agent prior to applying the composition on the support.

22. The mold of claim 13, wherein the mold is a negative mold.

23. The mold of claim 13, wherein the mold is a positive mold.

24. A method for adjusting the adhesion between a support and a photolithographic material comprising:

providing a support;

applying a priming agent to the support;

preparing a composition comprising a photolithographic material; and

applying the composition on the support.

25. The method of claim 24, wherein the priming agent comprises at least one polyol.

26. The method of claim 25, wherein at least one polyol is triethanol amine or ethylene glycol.

27. The method of claim 24, wherein the priming agent is a silane bonding agent.

28. The method of claim 27, wherein the silane bonding agent comprises a silane, a cyclohexane and an epoxy group.

29. The method of claim 27, wherein the silane bonding agent is 2(3,4-epoxycyclohexyl)ethyltrimethoxysilane.

30. The method of claim 24, wherein the priming agent is at least one of phosphoric acid, hydrochloric acid, NH_4OH, KOH, HF, and $NH_4OH:H_2O_2$.

31. The method of claim 24, wherein the photolithographic material comprises an epoxy bisphenol A novolac resin.

32. The method of claim 31, wherein the epoxy bisphenol A novolac resin is SU-8.

33. The method of claim 31, wherein the photolithographic material further comprises a crosslinking agent.

34. A method for forming a negative mold for forming spacers on a flat panel display comprising:

providing a positive mold comprising at least one post and a photolithographic material;

covering the positive mold with a composition;

allowing the composition to harden; and

removing the positive mold to reveal the negative mold comprising the hardened composition.

35. The method of claim 34, wherein the photolithographic material comprises an epoxy bisphenol A novolac resin.

36. The method of claim 35, wherein the epoxy bisphenol A novolac resin is SU-8.

37. The method of claim 35, wherein the photolithographic material further comprises a crosslinking agent.

38. The method of claim 34, wherein the composition comprises latex.

39. A mold for forming spacers on a flat panel display prepared by the process comprising:

adding a dry photolithographic material to a mixture comprising a solvent and a

photoinitiator;

applying the mixture to a support;

heating the mixture until the mixture forms a flowable composition on the support;

applying a photomask over the composition;

curing exposed portions of the composition; and

removing un-cured portions of the composition to reveal the mold.

40. The mold of claim 39, wherein the photolithographic material comprises an epoxy bisphenol A novolac resin.

41. The mold of claim 40, wherein the epoxy bisphenol A novolac resin is SU-8.

42. The mold of claim 40, wherein the photolithographic material further comprises a crosslinking agent.

43. The mold of claim 39, wherein the photolithographic material is present in an amount of 200-600 parts by weight, wherein the solvent is present in an amount of 200-600 parts by weight, and wherein the photoinitiator is present in an amount of about 1-100 parts by weight.

44. The mold of claim 39, further comprising priming the support with a priming agent prior to applying the mixture on the support.

45. The mold of claim 44, wherein the priming agent comprises at least one polyol.

46. The mold of claim 44, wherein the priming agent comprises at least one of triethanol amine, ethylene glycol, 2(3,4-epoxycyclohexyl)ethyltrimethoxysilane, phosphoric acid, hydrochloric acid, NH_4OH, KOH, HF, and $NH_4OH:H_2O_2$.

47. A method for forming a mold comprising:

providing a support;

placing alignment marks on the support;

applying a thick film photolithographic material on the support, wherein the thick film photolithographic material is positioned within the alignment marks on the support; and

curing the thick film photolithographic material to form the mold.

48. The method of claim 47, wherein the photolithographic material comprises an epoxy bisphenol A novolac resin.

49. The method of claim 48, wherein the epoxy bisphenol A novolac resin is SU-8.

50. The method of claim 48, wherein the photolithographic material further comprises a crosslinking agent.

51. The method of claim 47, further comprising priming the support with a priming agent prior to applying the thick film photolithographic material on the support.

52. A method for forming a mold comprising:

providing a support;

placing alignment marks on the support;

applying a transparent photolithographic material over the support;

placing a photomask on the photolithographic material, wherein the photomask is positioned within the alignment marks on the support;

curing the photolithographic material; and

removing the un-cured photolithographic material to reveal the mold.

53. The method of claim 52, wherein the photolithographic material comprises an epoxy bisphenol A novolac resin.

54. The method of claim 53, wherein the epoxy bisphenol A novolac resin is SU-8.

55. The method of claim 53, wherein the photolithographic material further comprises a crosslinking agent.

56. The method of claim 52, further comprising priming the support with a priming agent prior to applying the transparent photolithographic material on the support.

57. A method of forming at least one spacer on a substrate comprising:

applying a negative mold on a substrate, wherein the negative mold comprises a photolithographic material, and at least one hole;

applying a spacer material to the negative mold, wherein the spacer material fills the at least one hole;

hardening and bonding the spacer material to the substrate; and

removing the negative mold from the substrate, wherein the hardened spacer material remains bonded to the substrate.

58. The method of claim 57, wherein the method is performed in a vacuum.

59. The method of claim 57, wherein the photolithographic material comprises an epoxy bisphenol A novolac resin.

60. The method of claim 59, wherein the epoxy bisphenol novolac resin is SU-8.

61. The method of claim 57, wherein the spacer material comprises a sodium silicate and a potassium silicate.

62. The method of claim 57, wherein the substrate is the face plate or the base plate of a flat panel display.

63. A method of forming a spacer on a substrate comprising:

preparing a mold comprising at least one hole;

filling the at least one hole in the mold with a spacer material;

contacting the mold with a substrate;

allowing the spacer material to harden and bond to the substrate; and

removing the mold from the substrate, wherein the hardened spacer material remains bonded to the substrate.

64. The method of claim 63, wherein the spacer material comprises a sodium silicate and a potassium silicate.

65. The method of claim 63, wherein the substrate is the face plate or the base plate of a flat panel display.

66. A spacer for a flat panel display comprising sodium silicate and potassium silicate.

67. A method for preparing a spacer for a flat panel display comprising:

preparing a composition comprising formamide, potassium silicate and sodium silicate;

allowing the composition to form a gel; and

firing the gel to produce the spacer.

68. A flat panel display comprising:

a face plate;

a base plate; and

at least one spacer between the face plate and the base plate, wherein the spacer comprises a sodium silicate and a potassium silicate.

69. A method of forming spacers in a display comprising:

forming a positive mold by depositing a layer of photoresist on a support and patterning the layer of photoresist to define an array of posts;

forming a resilient negative mold by depositing a material over the positive mold, the material conforming to the array of posts, allowing the material to cure, and separating the cured material from the positive mold, the negative mold defining an array of apertures, each of the apertures corresponding to one of the posts;

placing the negative mold in contact with a substrate;

filling the apertures with a spacer material;

allowing the spacer material to cure; and

separating the negative mold and the substrate.

70. A method according to claim 69, wherein the negative mold comprises a first layer of material characterized by a first durometer and a second layer of material characterized by a second durometer, the second durometer being higher than the first durometer, the first layer defining the array of apertures.

71. A method according to claim 69, wherein the negative mold comprises an alignment sheet, the alignment sheet defining two or more alignment apertures.

72. A method according to claim 71, wherein the alignment sheet is metallic.

73. A method according to claim 69, wherein filling the apertures with spacer material comprises injecting the spacer material into the negative mold.

74. A method according to claim 69, wherein the negative mold comprises a plurality of vacuum pump out channels.

75. A method of forming spacers on a display comprising:

providing a resilient negative mold, the negative mold comprising a first layer and a second layer, the first layer being characterized by a first durometer, the second layer being characterized by a second durometer, the second durometer being higher than the first durometer, the first layer defining a plurality of apertures and a plurality of vacuum pump out channels;

placing the negative mold in contact with a substrate;

using the vacuum pump out channels to remove gas from between the substrate and the negative mold;

filling the apertures with a spacer material;

allowing some of the spacer material to cure and to become attached to the substrate;

separating the substrate from the negative mold.

76. A method according to claim 75, wherein the negative mold comprises an alignment sheet, the alignment sheet defining at least two alignment apertures.

77. A method according to claim 76, wherein the alignment sheet is metallic.